Effects of domain walls and spin polarization in super / ferro hybrids.

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In superconductor / ferromagnet hybrids the suppression of superconductivity by the exchange field h_{ex} of the ferromagnet can be partially lifted when different directions of h_{ex} are sampled simultaneously by the Cooper pair. Different aspects of this effect will be reviewed. In S/F bilayers, the inhomogeneous exchange fields inside a domain wall can lead to enhanced superconductivity, which was observed in combinations of Nb and strongly magnetic Permalloy (Py)[1] and weakly magnetic CuNi. In F/S/F trilayers, control over the magnetization directions of the F-layers should allow switching between the superconducting state when the magnetizations are antiparallel (AP) and the normal state when they are parallel (P). Small effects in the resistive transition were observed with weak magnets such as CuNi[2]. However, with stronger magnets such as Py, the opposite effect is found, namely an increase of the resistance in the AP-configuration. This is reminiscent of the effect of Giant Magnetoresistance as found in ferromagnet / normal metal combinations , and appears to be due to the strong spin polarization of the quasiparticles.

[1] A. Rusanov *et al.*, Phys. Rev. Lett **93**, 057002 (2004).
[2] J.Y. Gu *et al.*, Phys. Rev. Lett. **89**, 267001 (2002).

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